# 400G QSFP-DD Direct Attach Cable
# TSQS-PC4HG-xxM

## Features

- Compatible with IEEE 802.3bj and IEEE 802.3cd
- Supports aggregate data rates of 400Gbps(PAM4)
- Optimized construction to minimize insertion loss and cross talk
- Pull-to-release slide latch design
- 28AWG through 30AWG cable
- Straight and break out assembly configurations available
- Customized cable braid termination limits EMI radiation
- Customizable EEPROM mapping for cable signature
- RoHS Compatible

## Applications

- Switches, servers and routers
- Data Center networks
- Storage area networks
- High performance computing
- Telecommunication and wireless infrastructure
- Medical diagnostics and networking
- Test and measurement equipment
- 400G Ethernet (IEEE 802.3cd)
- InfiniBand

## General Description

QSFP-DD passive copper cable assembly feature eight differential copper pairs, providing four data transmission channels at speeds up to 56Gbps(PAM4) per channel, and meets 400G Ethernet and InfiniBand requirements. Available in a broad range of wire gages from 28AWG through 30AWG-this 400G copper cable assembly features low insertion loss and low cross talk.

QSFP-DD uses PAM4 signals for transmission, which doubles the rate. However, there are more stringent requirements for cable insertion loss. For detailed requirements, please see High Speed Characteristics.

Version 1.0

## Recommended Operation Condition

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Operating Case Temperature | Topc | 0 | 70 | degC |
| Storage Temperature | Tst | -40 | 85 | degC |
| Relative Humidity (non-condensation) | RS | 35 | 60 | % |
| Supply Voltage | VCC3 | 3.135 | 3.465 | V |
| Voltage on LVTTL Input | Vilvttl | -0.3 | VCC3  +0.2 | V |
| Power Supply Current | ICC3 | - | 15 | mA |
| Total Power Consumption | Pd | - | 0.05 | W |

**Notes:**

Stress or conditions exceed the above range may cause permanent damage to the device.

This is a stress rating only and functional operation of the device at these or any other conditions above those listed in the operational sections of this specification is not applied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## Pin Descriptions

| Pin | Logic | Symbol | Description |
|---|---|---|---|
| 1 | - | GND | Ground |
| 2 | CML-I | Tx2n | Transmitter Inverted Data Input |
| 3 | CML-I | Tx2p | Transmitter Non-Inverted Data Input |
| 4 | - | GND | Ground |
| 5 | CML-I | Tx4n | Transmitter Inverted Data Input |
| 6 | CML-I | Tx4p | Transmitter Non-Inverted Data Input |
| 7 | - | GND | Ground |
| 8 | LVTTL-I | ModSelL | Module Select |
| 9 | LVTTL-I | ResetL | Module Reset |
| 10 | - | Vcc Rx | +3.3V Power Supply Receiver |
| 11 | LVCMOS-I/O | SCL | 2-wire serial interface clock |
| 12 | LVCMOS-I/O | SDA | 2-wire serial interface data |
| 13 | - | GND | Ground |
| 14 | CML-O | Rx3p | Receiver Non-Inverted Data Output |
| 15 | CML-O | Rx3n | Receiver Inverted Data Output |
| 16 | - | GND | Ground |

| 17 | CML-O | Rx1p | Receiver Non-Inverted Data Output |
| 18 | CML-O | Rx1n | Receiver Inverted Data Output |
| 19 | - | GND | Ground |
| 20 | - | GND | Ground |
| 21 | CML-O | Rx2n | Receiver Inverted Data Output |
| 22 | CML-O | Rx2p | Receiver Non-Inverted Data Output |
| 23 | - | GND | Ground |
| 24 | CML-O | Rx4n | Receiver Inverted Data Output |
| 25 | CML-O | Rx4p | Receiver Non-Inverted Data Output |
| 26 | - | GND | Ground |
| 27 | LVTTL-O | ModPrsL | Module Present |
| 28 | LVTTL-O | IntL | Interrupt |
| 29 | - | Vcc Tx | +3.3V Power supply transmitter |
| 30 | - | Vcc1 | +3.3V Power supply |
| 31 | LVTTL-I | LPMode | Low Power Mode |
| 32 | - | GND | Ground |
| 33 | CML-I | Tx3p | Transmitter Non-Inverted Data Input |
| 34 | CML-I | Tx3n | Transmitter Inverted Data Input |
| 35 | - | GND | Ground |
| 36 | CML-I | Tx1p | Transmitter Non-Inverted Data Input |
| 37 | CML-I | Tx1n | Transmitter Inverted Data Input |
| 38 | - | GND | Ground |
| 39 | - | GND | Ground |
| 40 | CML-I | Tx6n | Transmitter Inverted Data Input |
| 41 | CML-I | Tx6p | Transmitter Non-Inverted Data Input |
| 42 | - | GND | Ground |
| 43 | CML-I | Tx8n | Transmitter Inverted Data Input |
| 44 | CML-I | Tx8p | Transmitter Non-Inverted Data Input |
| 45 | - | GND | Ground |
| 46 | - | Reserved | - |
| 47 | - | VS1 | - |
| 48 | - | VccRx1 | +3.3V Power supply |
| 49 | - | VS2 | - |
| 50 | - | VS3 | - |

Version 1.0

| 51 | - | GND | Ground |
|----|---|-----|--------|
| 52 | CML-O | Rx7p | Receiver Non-Inverted Data Output |
| 53 | CML-O | Rx7n | Receiver Inverted Data Output |
| 54 | - | GND | Ground |
| 55 | CML-O | Rx5p | Receiver Non-Inverted Data Output |
| 56 | CML-O | Rx5n | Receiver Inverted Data Output |
| 57 | - | GND | Ground |
| 58 | - | GND | Ground |
| 59 | CML-O | Rx6n | Receiver Inverted Data Output |
| 60 | CML-O | Rx6p | Receiver Non-Inverted Data Output |
| 61 | - | GND | Ground |
| 62 | CML-O | Rx8n | Receiver Inverted Data Output |
| 63 | CML-O | Rx8p | Receiver Non-Inverted Data Output |
| 64 | - | GND | Ground |
| 65 | - | NC | - |
| 66 | - | Reserved | - |
| 67 | - | VccTx1 | +3.3V Power supply |
| 68 | - | VCC2 | +3.3V Power supply |
| 69 | - | Reserved | - |
| 70 | - | GND | Ground |
| 71 | CML-I | Tx7p | Transmitter Non-Inverted Data Input |
| 72 | CML-I | Tx7n | Transmitter Inverted Data Input |
| 73 | - | GND | Ground |
| 74 | CML-I | Tx5p | Transmitter Non-Inverted Data Input |
| 75 | CML-I | Tx5n | Transmitter Inverted Data Input |
| 76 | - | GND | Ground |

## High Speed Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|-----------|--------|-----|---------|-----|------|------|
| Differential Impedance | TDR | 90 | 100 | 110 | Ω | - |
| Insertion loss | SDD21 | -16.06 | - | -8 | dB | At 13.28 GHz |
| Differential Return Loss | SDD11 SDD22 | -12.45 | - | See 1 | dB | At 0.05 to 4.1 GHz |
| | | -3.12 | - | See 2 | dB | At 4.1 to 19 GHz |

| Common-mode to common-mode | SCC11 | - | - | -2 | dB | At 0.2 to 19 GHz |
|---|---|---|---|---|---|---|
| Differential to common-mode return loss | SCD11 SCD22 | -12 | - | See 3 | dB | At 0.01 to 12.89 GHz |
| | | -10.58 | - | See 4 | | At 12.89 to 19 GHz |
| Differential to common Mode Conversion Loss | SCD21-IL | - | - | -10 | dB | At 0.01 to 12.89 GHz |
| | | - | - | See 5 | | At 12.89 to 15.7 GHz |
| | | - | - | -6.3 | | At 15.7 to 19 GHz |
| Channel Operating Margin | COM | - | - | -3 | dB | - |

## Pin Descriptions
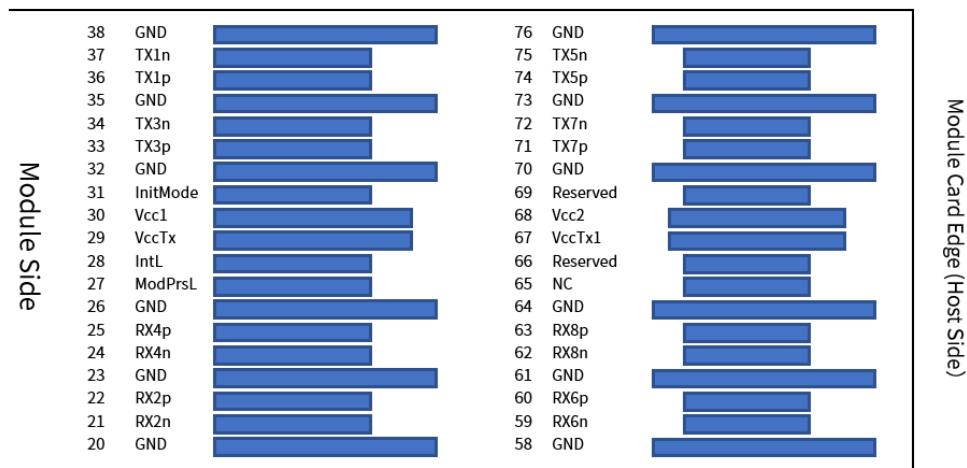


Top side viewed from bottom
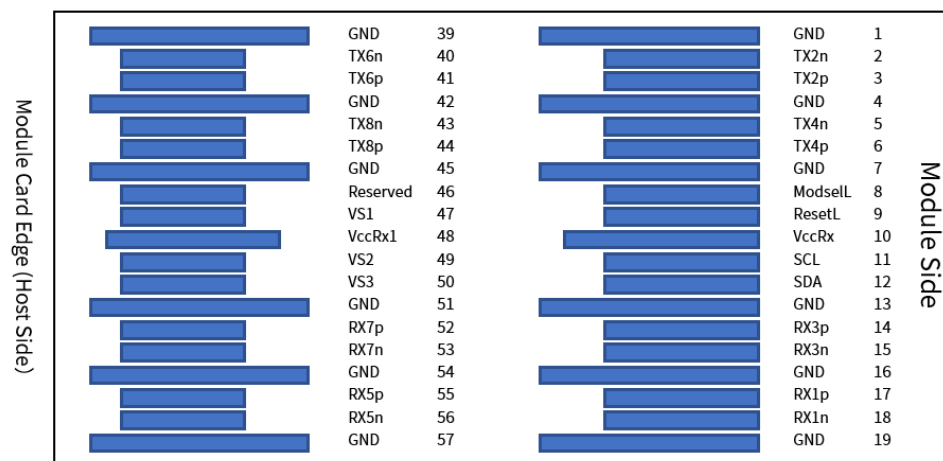


Bottom side viewed from bottom

## Ordering Information

400G QSFPDD Copper Cable Assemblies, Passive.

| P/N | Length | Data Rate | AWG | Length Tolerance |
|---|---|---|---|---|
| TSQS-PC4HG-01M | 1M | 400G | 30 | +3.5/-3.5cm |
| TSQS-PC4HG-02M | 2M | 400G | 28 | +3.5/-3.5cm |
| TSQS-PC4HG-03M | 3M | 400G | 28 | +4/-4cm |

Information and specifications are subject to change without notice.
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Version 1.0